**4.8, 4.9 EXAM QUESTIONS MS**

**1.** (a) *Equation* CH3COCl + CH3CH2OH  CH3COOCH2CH3 + HCl **(1)**

*Name of mechanism* addition-elimination **(1)**

*Mechanism*

 6

(b) Only the polyester **(1)** is hydrolysed **(1)** by alkali 2

[8]

**2.** (a) elimination **(1)** 1

(b) melting point increases **(1)**

boiling point increases**(1)**

**or** they are liquids, the higher members are solids**(1)**

density increases**(1)**

viscosity increases**(1)** max 2

(c) addition **(1)**

polymerisation **(1)** 2

(d) (i) C2H4 + H2O C2H5OH - must show the functional group **(1)** 1

(ii) vapour phase / high temperature (300 ± 50°C) **(1)**

high pressure 70cl ± 20 **(1)**

 if high *T* and high *p*, then only 1 mark, value for either gives 2nd mark
strong acidic catalyst /H3PO4 **(1)** 3

(iii) electrophilic **(1)**

addition **(1)** 2

[11]

**3.** (a) necleophilic addition; 1



 M3 structure ; 4

(be lenient on position of charge on CN– )
(M2 not allowed independent of M1, but allow M1 for correct attack on C+
if M2 show as independent first.)
(+on C of C=O loses M2 but ignore + if correct)
(M4 for arrow and lone pair (only allow for correct M3 or close))

(b) (i) 2-hydroxybutanoic acid 1

(ii)



 1

 1

geometric(al) or cis-trans 1

(c) (i)



 1

(one unit only) (ignore brackets or n) (trailing bonds are needed)

(ii) can be hydrolysed

 OR

 can be reacted with/attacked by acid/base/nucleophiles/H2O/OH–; 1

(d) (i)

 1

(allow –NH3+)

(ii)

 1

(or zwitterions product)

(iii) nucleophilic substitution; 1

[14]

**4.** (a) (i)


 penalise +NH3— or + on H once per paper 1

 zwitterions 1

(ii)
 1

(b)


ignore n, but allow **one** drawn out repeating unit only 1

 condensation or (nucleophilic) addition-elimination 1

(c) 3-methylpent-2-ene 1

[6]

**5.** (a) (i)  1

(Ignore n or brackets, but trailing bonds are essential)

(ii) Addition or radical 1

(b) (i) 2-aminobutanoic (acid) 1

(ii)  1

(c) (i) C3H4O2 1

(ii)  1

(1,4-)butan(e)dioic (acid) 1

(allow succinic, but not dibutanoic nor butanedicarboxylic acid)

(iii) Can be hydrolysed / can react with acid or base or water / 1
can react with nucleophiles

[8]

**6.** (a) (i) 2-methylbut-1-ene **(1)**

NOT ...butan....

(ii) *Repeating unit:* or 2 ×

allow C2H5

 *Type of polymerisation*: addition or radical **(1)**

(iii) *Name of mechanism*: electrophilic substitution **(1)**

 *Major product:* 

(iv) CH3CH=CHCH2CH3 **(1)** 6

(b) *Repeating unit*:



*Type of polymerisation*: condensation **(1)**

*Name of linkage*: (poly)peptide or (poly)amide **(1)** 4

allow outer horizontal bonds to be omitted
allow HO–[...........]–H if [......] shows the repeating unit; if brackets missing in the dimer, penalise one
C2H4 or C6H12 first time only
allow CONH
allow polypeptide or polyamide; peptide or amide **must** be spelled correctly

Organic points

(1) Curly arrows: must show movement of a pair of electrons,
i.e. from bond to atom or from lp to atom / space
e.g.



(2) Structures

penalise sticks (i.e. ) once per paper



Penalise once per paper

 allow CH3– or –CH3 or  or CH3
 or H3C–

[10]

**7.** (a) (i)  **(1)** 1

 (ii)  allow HOCH2CH2OH **(1)** 1

(iii) 

ester linkage correct ie –COO–CH2– shown as fully graphical structure **(1)**

rest of molecule correct including  **(1)**

 repeat unit may start and finish in different place
allow e.c.f. from (a)(ii) 2

(b) polyesters **(1)** 1

(c) addition: joining together (of monomers with double bond) 
one product only **(1)**

 condensation: also involves the elimination of a small molecule **(1)**
allow specific example e.g. H2O, HCl, CH3OH 2

(d) poly(ethene) / poly(propene)
condone missing brackets **(1)** 1

[8]

**8.** (a) *Substance 1*: HCl or HBr **(1)***Substance 2*: AlCl3 / AlBr3 / FeCl3 / FeBr3 **(1)** 2

(b) H2C==CH2 + HCl +AlCl3  CH3CH2+ + AlCl4– **(1)**

Allow 2 equations 1

(c) *Name of mechanism*: electrophilic substitution **(1)***Mechanism:*  4

(d)  1

(e) *Type of polymerisation*: addition **(1)***Repeating unit*:  **(1)** 2

[10]

**9.** (a) (i) hexane-1,6-diamine or 1,6-diaminohexane **(allow ammine)**or 1,6 hexan(e)diamine **(1)**

(ii) 

Allow –CONH–

 2

(b) (i) 

(ii)  2

(c) (i) quaternary ammonium bromide salt **(1)**

(not ion, not compound)

Allow quarternery

(ii) *Reagent*: CH3Br or bromomethane **(1)**

penalise CH3Cl but allow excess for any halomethane

 *Condition*: excess (CH3Br) **(1)**

(iii) nucleophilic substitution **(1)** 4

[8]

**10.** (a)  **(1)**

 5

(b) 1

 **(1)**

(c) ester or alkoxy alcohol **(1)** 1

(d) (i) HO–CH2–CH2–OH **(1)**

 (ii) high electron density of double bond **(1)**
repels OH– or nucleophile **(1)** 3

[10]

**11.** (a) (i) the joining together of monomers / small molecules **(1)**

 to form long chains / large molecules **(1)** 2

(ii) nCH2 = CH2  (-CH2–CH2~~-)~~n **(1)**

 allow n CH2 CH2 **not** n C2H4 1

(b) 1,2-dibromoethane **(1)** 1

(c) electrophilic addition **(1)**



 words or diagrams to show attack by p electrons on Br atom
**and either** +/– on Br2 or e– shift on Br–Br **(1)**

 correct carbocation intermediate (allow triangular representation) **(1)**

 attack by Br– (onto +ve carbon) leading to correct product **(1)** 4

(d) (i) C 38.71/12 = 3.23 ; H 9.68/1 = 9.68 ; O 51.61/16 = 3.23 **(1)**

 ratio C:H:O = 1:3:1 /empirical formula = CH3O **(1)**

 empirical mass = 31 so molecular formula = 2 × CH3O = C2H6O2 **(1)** 3

(ii) reagent = NaOH / KOH **(1)**

 conditions = aqueous solution (dependent on first mark) **(1)** 2

(iii) CH2BrCH2Br + 2NaOH  CH2(OH)CH2OH + 2NaBr

 product = CH2(OH)CH2OH (condone missing brackets) **(1)**

 correctly balanced **(1)** 2

 if C2H6O2 given, allow second mark only

 for CH2 Br CH2 Br + 2H2O  CH2(OH)CH2(OH) + 2HBr
allow 2 marks if reagent in (ii) is H2O or aqueous solution

[15]

**12.** (a) CH3COCl or (CH3CO)2O **(1)**

AlCl3 or H2O or CH2SO4 loses this mark
CH3COOH loses reagent and M3, M4 = max 3

 nucleophilic addition–elimination **(1)**

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M3: structure
M4: 3 correct arrows
Allow M1 for attack on CH3-C+=O
Penalise Cl– removing H+

 6

(b) Conc HNO3 **(1)**Conc H2SO4 **(1)**
HNO3 + 2 H2SO4  NO2+ + H3O+ + 2 HSO4– **(2)
 (or H2SO4 ) (or H2O + HSO4–)**

HNO3 / H2SO4 scores 1
Any 2

 electrophilic substitution **(1)**



M2 structure
M3 arrow

 6

(c) Sn **(or Fe)** / HCl or Ni / H2 **(1)**

NOT LiAlH4 NaBH4

 3

[15]